PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-273468
(43)Date of publication of application : 21.10.1997

(51)Int.Cl. F02P 5/15

(21)Application number : 08-298402
(22)Date of filing : 11.11.1996

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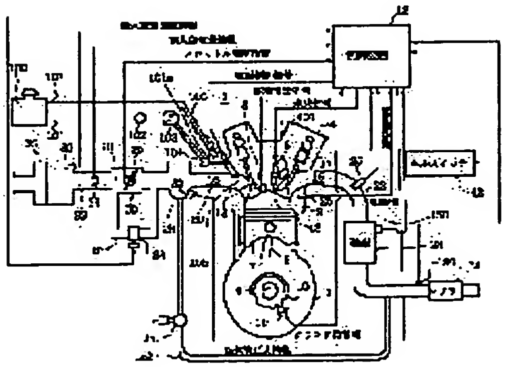
(30)Priority
Priority number : 07292258 Priority date : 10.11.1995 Priority country : JP

(54) ENGINE CONTROL METHOD

(57)Abstract:



PROBLEM TO BE SOLVED: To improve the accelerating property by detecting real combustion ratio till one or plural predetermined clank angle at the time of detecting transition, and controlling an engine so that the ignition period is advanced in the case where the detected value is smaller and that ignition period is delayed in the case where the detected value is larger.

SOLUTION: In a control device 12, to which the output signal of various sensor for detecting engine operating condition is input, at the time of detecting transition, ignition period is corrected for advance than the ignition period based on the engine operating condition. Combustion condition that the optimal torque is obtained and that NOx is lowered is obtained, and in this combustion condition, one or plural combustion ratios at the predetermined clank angle are stored as map data of plural target combustion ratio value. Real combustion ratio till the predetermined clank angle is detected, and compared with the target combustion ratio value, and control is performed so that ignition period is advanced in the case where the detected value is smaller than the target value and that ignition period is delayed in the case where the detected value is larger than the target value.

LEGAL STATUS

[Date of request for examination]	13.06.2002
[Date of sending the examiner's decision of rejection]	01.05.2006
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side The actual combustion rate to said 1 or two or more predetermined crank angles is detected. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of said ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- ignition timing -- controlling -- things -- the description -- carrying out -- an engine -- the control approach.
[Claim 2] the time of transient detection -- a throttle opening -- or -- and, while carrying out loading amendment from the amount of fuel supply based on an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side The actual combustion rate to said 1 or two or more predetermined crank angles is detected. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of said amount of fuel supply -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling -- things -- the description -- carrying out -- an engine -- the control approach.
[Claim 3] While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side The actual combustion rate to said 1 or two or more predetermined crank angles is detected. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of said ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- the correction value of the amount of said fuel supply after controlling ignition timing -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling -- things -- the description -- carrying out -- an engine -- the

control approach.
[Claim 4] While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side The actual crank angle value to said 1 or two or more predetermined combustion rates is detected. The control approach of the engine characterized by controlling ignition timing so that it sets forward a fire stage when the detection value is later, and a fire stage may be delayed in addition to the correction value of said ignition timing based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier.
[Claim 5] While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side The actual crank angle value to said 1 or two or more predetermined combustion rates is detected. The control approach of the engine characterized by controlling the amount of fuel supply so that it increases the quantity of the amount of fuel supply when the detection value is later, and the amount of fuel supply may be decreased in addition to the correction value of said amount of fuel supply based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier.
[Claim 6] While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side The actual crank angle value to said 1 or two or more predetermined combustion rates is detected. So that it sets forward a fire stage when the detection value is later, and a fire stage may be delayed in addition to the correction value of said ignition timing based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier The control approach of the engine characterized by controlling the amount of fuel supply so that in addition to the correction value of said fuel oil consumption the amount of fuel supply is increased when the detection value is later, and the amount of fuel supply may be decreased when the detection value is earlier after controlling ignition timing.
[Claim 7] The actual combustion rate to said predetermined crank angle is the control approach of the engine characterized by detecting the firing pressure in at least four crank angles which consist of the crank angles of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], crank angles from compression stroke initiation to ignition , and two crank angles in the period from ignition initiation to exhaust stroke initiation , and making it compute based on these combustion rate data .
[Claim 8] The actual crank angle which reach said predetermined combustion rate value be the control approach of the engine characterize by detect the firing pressure in at least four crank angles which consist of the crank angles from after termination of an exhaust stroke to the early stages of a compression stroke , crank angles from compression stroke initiation to ignition , and two crank angles in the period from ignition initiation to exhaust stroke initiation , and make it compute based on these combustion rate data .

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the control approach of a two-cycle jump-spark-ignition engine or a four-cycle jump-spark-ignition engine.
[0002]
[Description of the Prior Art] In a two-cycle jump-spark-ignition engine or a four-cycle jump-spark-ignition engine, if it judges with transient operation of sudden acceleration or a sudden slowdown, there will be a technique of performing the amount of increase and decrease between predetermined time about the fuel of the specified quantity, and sudden acceleration nature can be improved by this, and prevention of the engine stall accompanying a sudden slowdown will be attained.
[0003] Moreover, when it judges with transient operation of sudden acceleration or a sudden slowdown, there is a technique of performing the ignition-timing tooth lead angle or the angle of delay of the specified quantity between predetermined time. Corresponding to the decrease of -, ignition timing is set to a tooth lead angle and the thing which carries out the angle of delay. or the increase of a throttle opening -- If it judges with transient operation of sudden acceleration or a sudden slowdown, in sudden acceleration, the rate of the tooth lead angle to the increment in a throttle opening will be enlarged more between predetermined time. In a sudden slowdown There is an ignition timing adjustment technique which makes smaller the rate of the angle of delay to reduction of a throttle opening, and improvement in sudden acceleration nature and the engine stall at the time of a sudden slowdown are similarly prevented by these.
[0004]
[Problem(s) to be Solved by the Invention] By the way, although fuel increase loss in quantity of the specified quantity is performed between predetermined time and the ignition-timing tooth lead angle or the angle of delay of the specified quantity is performed between predetermined time, between predetermined time, the specified quantity is the value defined beforehand, since it cannot fully respond to dispersion in production, secular change, and operational status, the transient overshoot of A/F and undershoot will arise, it will worsen acceleration nature, and the engine stall at the time of a sudden slowdown will generate it.
[0005] It aims at offering the control approach of the engine which this invention discovers that there is correlation with the crank angle high to engine power and exhaust-air emission which reaches the combustion rate and the predetermined combustion rate to a predetermined crank angle, engine power can maintain it greatly, and can improve [was made in view of this point, and] acceleration nature, or can improve the engine stall tightness at the time of a sudden slowdown, and can improve the exhaust-air emission nature at the time of a transient response further.
[0006]
[Means for Solving the Problem] In order to solve said technical problem and to attain the object, the control approach of the engine invention according to claim 1 While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target

combustion rate values at least corresponding to one side The actual combustion rate to said 1 or two or more predetermined crank angles is detected. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of said ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- ignition timing -- controlling -- things -- the description -- carrying out -- **** .
[0007] Thus, while carrying out tooth-lead-angle amendment of the ignition timing at the time of transient detection, the combustion condition that NOx falls while the best torque is acquired is acquired. The actual combustion rate to 1 or two or more predetermined crank angles is detected in this combustion condition. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- ignition timing -- controlling .

[0008] The control approach of the engine invention according to claim 2 the time of transient detection -- a throttle opening -- or -- and, while carrying out loading amendment from the amount of fuel supply based on an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side The actual combustion rate to said 1 or two or more predetermined crank angles is detected. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of said amount of fuel supply -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling -- things -- the description -- carrying out -- **** .
[0009] Thus, while carrying out loading amendment of the amount of fuel supply at the time of transient detection, the combustion condition that NOx falls while the best torque is acquired is acquired. The actual combustion rate to 1 or two or more predetermined crank angles is detected in this combustion condition. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of the amount of fuel supply -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling .
[0010] The control approach of the engine invention according to claim 3 While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side The actual combustion rate to said 1 or two or more predetermined crank angles is detected. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of said ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- the correction value of the amount of said fuel supply after controlling ignition timing -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling -- things -- the description -- carrying out -- **** .
[0011] Thus, while carrying out tooth-lead-angle amendment of the ignition timing at the time of transient detection and carrying out loading amendment of the amount of fuel supply The

combustion condition that NOx falls while the best torque is acquired is acquired. At the time of this combustion condition Detect the actual combustion rate to 1 or two or more predetermined crank angles, and it is based on the comparison with the detection value of this combustion rate, and a target combustion rate value. the correction value of ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- the correction value of the amount of said fuel supply after controlling ignition timing -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling .

[0012] The control approach of the engine invention according to claim 4 While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side The actual crank angle value to said 1 or two or more predetermined combustion rates is detected. It is characterized by controlling ignition timing so that it sets forward a fire stage when the detection value is later, and a fire stage may be delayed in addition to the correction value of said ignition timing based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier.

[0013] Thus, while carrying out tooth-lead-angle amendment of the ignition timing at the time of transient detection, the combustion condition that NOx falls while the best torque is acquired is acquired. The actual crank angle value to 1 or two or more predetermined combustion rates is detected in this combustion condition. Based on the comparison with the detection value of this crank angle, and a target crank angle value, in addition to the correction value of ignition timing, when the detection value is later, a fire stage is set forward, and when the detection value is earlier, ignition timing is controlled to delay a fire stage.

[0014] The control approach of the engine invention according to claim 5 While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side The actual crank angle value to said 1 or two or more predetermined combustion rates is detected. It is characterized by controlling the amount of fuel supply so that it increases the quantity of the amount of fuel supply when the detection value is later, and the amount of fuel supply may be decreased in addition to the correction value of said amount of fuel supply based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier.

[0015] Thus, while carrying out tooth-lead-angle amendment of the ignition timing at the time of transient detection, the combustion condition that NOx falls while the best torque is acquired is acquired. The actual crank angle value to 1 or two or more predetermined combustion rates is detected in this combustion condition. the comparison with the detection value of this crank angle, and a target crank angle value -- being based -- the correction value of the amount of fuel supply -- in addition, the direction of a detection value -- size -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling .

[0016] The control approach of the engine invention according to claim 6 While reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side The actual crank angle value to said 1 or two or more predetermined combustion rates is detected. So that it sets forward a fire stage when the detection value is later, and a fire stage may be delayed in addition to the correction value of said ignition timing based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier After controlling ignition timing, it is characterized by controlling the amount of fuel supply so that in addition to the correction value of said fuel oil consumption it increases the amount of fuel supply when the detection value is later, and the amount of fuel supply may be decreased, when the detection value is earlier.

[0017] Thus, while carrying out tooth-lead-angle amendment of the ignition timing at the time of transient detection and carrying out loading amendment of the amount of fuel supply The combustion condition that NOx falls while the best torque is acquired is acquired. At the time of this combustion condition Detect the actual crank angle value to 1 or two or more predetermined combustion rates, and it is based on the comparison with the detection value of this crank angle, and a target crank angle value. So that in addition to the correction value of ignition timing it sets forward a fire stage when the detection value is later, and a fire stage may be delayed, when the detection value is earlier In addition to the correction value of fuel oil consumption, after controlling ignition timing, when the detection value is later, the amount of fuel supply is increased, and when the detection value is earlier, the amount of fuel supply is controlled to decrease the amount of fuel supply.

[0018] The control approach of the engine invention according to claim 7 The actual combustion rate to said predetermined crank angle The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected, and it is characterized by making it compute based on these combustion rate data.

[0019] The control approach of the engine invention according to claim 8 The actual crank angle which reaches said predetermined combustion rate value The crank angle from after termination of an exhaust stroke to the early stages of a compression stroke, and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected, and it is characterized by making it compute based on these combustion rate data.

[0020]

[Embodiment of the Invention] Hereafter, the control approach of the engine this invention is explained to a detail based on a drawing.

[0021] Drawing 1 is a block diagram of the jump-spark-ignition type four stroke cycle engine which is two or more cylinders with which this invention is applied. This engine 1 is constituted by a crank case 2, and the cylinder body 3 and the cylinder head 4 of that upper part. In a cylinder body 3, it is equipped with a piston 7 possible [sliding] through a connecting rod 8, and the connecting rod 8 is connected with the crankshaft 9. A crankshaft 9 is equipped with the flywheel starter gear 10 which have a predetermined number of teeth, and it has the crank angle sensor 11 which serves as the engine speed sensor for detecting the revolution location of these flywheel starter gear 10, and measuring a crank angle and an engine speed. A combustion chamber 13 is formed between the cylinder head 4 and a piston 7, and the ignition plug 400 is formed so that this combustion chamber 13 may be attended.

[0022] Moreover, the combustion room pressure sensor 5 for detecting the firing pressure in a combustion chamber 13 is formed in a cylinder head 4 side. The cooling water jacket 6 is formed in the suitable location of the cylinder head 4 and a cylinder body 3. In a combustion chamber 13, a flueway 15 and the inhalation-of-air path 16 are open for free passage, and an exhaust valve 17 and an inlet valve 18 are formed in the opening, respectively. In the middle of the exhaust pipe 22 connected to the flueway 15, the catalysts 23, such as a three way component catalyst for exhaust gas clarification, are established, and the muffler 24 is formed in the edge. The oxygen density sensor (O2 sensor) 25 and the exhaust pipe temperature sensor 120 are formed in an exhaust pipe 22, and it connects with the control unit 12, respectively.

[0023] The cylinder head 4 is equipped with a temperature sensor 26, and the temperature information on a combustion chamber 13 is sent to a control unit 12. Moreover, a sensor 150 is formed in a catalyst 23 whenever [catalyst temperature / which was connected with the control unit 12]. The kill switch 43 of an engine 1 is further connected to a control device 12, and the halt information on engine drive control is acquired.

[0024] On the other hand, an inlet pipe 20 is connected to the inhalation-of-air path 16, and an inlet pipe 20 is connected with each cylinder through the inhalation-of-air distribution tube 28. The inhalation-of-air distribution tube 28 is equipped with the pressure-of-induction-pipe force sensor 32, and pressure-of-induction-pipe force information is sent to a control unit 12. The inhalation-of-air distribution tube 28 and an exhaust pipe 22 are connected, and the EGR tubing 152 is formed. The EGR regulator valve 151 connected with the control unit 12 is formed in the EGR tubing 152. An air cleaner 35 is ****(ed) by the inhalation-of-air distribution tube 28 through an inlet pipe 33. The inhalation air temperature sensor 36 is formed in an air cleaner 35, and inhalation air-temperature information is sent to a control unit 12. The inspired-air-volume regulator 30 is formed in the middle of an inlet pipe 33, and the inspired-air-volume regulator 30 is equipped with the throttle valve 29.

[0025] The throttle opening sensor 31 is formed in a throttle valve 29, and this throttle opening sensor 31 is connected with a control unit 12. The throttle-valve detour path 37 is established in the inlet pipe 33 of inspired-air-volume regulator 30 part, and the detour path opening regulator valve 38 is formed in this detour path 37. The detour path opening regulator valve 38 is connected with a control unit 12. In an inlet pipe 33, the heat ray type inhalation air content sensor 34 is formed, and inhalation air content information is sent to a control unit 12.

[0026] An injector 105 is formed in the upstream of the inlet valve 18 of the inhalation-of-air path 16 for every inlet port of each cylinder. An injector 105 is connected with a control unit 12, and the control signal of the optimal injection quantity calculated according to operational status is sent. A fuel is sent to each injector 105 through fuel pipe 101a connected with each cylinder. Fuel pipe 101a branches from the fuel distribution tube 104, it lets a fuel feeding pipe 101 pass from a fuel tank 100 to this fuel distribution tube 104, and a fuel is further sent by the fuel pump 103 through a filter 102. The fuels which were not injected from an injector 105 are collected through the fuel return pipe 107 in a fuel tank 100. A regulator 106 is formed in the fuel return pipe 107, and fuel injection pressure is kept constant.

[0027] Drawing 2 is the flow chart of the main routine which controls various engine operational status. Each step is explained below.

[0028] Step S11: Initialization is performed and initial value is set to each flag value and each variable value.

[0029] Step S12 : The inhalation air-temperature information from the inhalation air temperature sensor 36, The inhalation air content information from the heat ray type inhalation air content sensor 34, the throttle opening information from the throttle opening sensor 31, Whenever [from a sensor 150 / catalyst temperature] Information, [whenever / pressure-of-induction-pipe force information / from the pressure-of-induction-pipe force sensor 32 / and catalyst temperature] The crank angle information from the crank angle sensor 11, the temperature information from a temperature sensor 26, The exhaust pipe temperature information from the exhaust pipe temperature sensor 120, the oxygen density information from the oxygen density sensor 25, and the oil residue information from a non-illustrated oil sensor are incorporated, and the data is memorized to memory A (i). An engine load can be grasped as an accelerator location or a throttle opening. If this throttle opening and engine speed are decided, since an inhalation air content is decided the case at the time of steady operation, an inhalation air content can be detected directly and it can be regarded as an engine load. Moreover, if an engine speed is decided, since inlet-pipe negative pressure has the fixed relation to a throttle opening, inlet-pipe negative pressure can be detected and it can be regarded as an engine load.

[0030] Step S13: Incorporate switch information, such as ON of the main switch which is not illustrated [ON of the kill switch 43, OFF and], OFF and ON of a non-illustrated starting switch,

and OFF, and memorize to memory B (i). The kill switch 43 is a switch for emergency shut downs, and the engine for small marine vessels is equipped with it without preparing for the engine for cars.
[0031] Step S14: Operational status judges based on the sensor information incorporated in said step 12, and the switch information incorporated at said step 13, and input the value corresponding to the variable C in memory corresponding to this operational status **, **, **, **, **, **, **, **, **, and A**.
[0032] Operational status ** ... Beyond a predetermined value, an engine speed judges with a MBT (Minimum Advance Ignition for Best Torque) control state in the fixed accelerator condition that the rate of change of beyond a predetermined value and a throttle opening is not in the inside high-speed revolution below a predetermined value, an inside high-speed load, and a sudden acceleration-and-deceleration condition, or a ** accelerator actuation condition, and a throttle opening carries out memory of 1 to Variable C.
[0033] Operational status ** ... When the rate of change of a throttle opening is beyond a predetermined value, it judges with transient operational status and memory of 2 is carried out to Variable C.
[0034] Operational status ** ... When below a predetermined value and an engine speed are between predetermined region, for example, 1000rpm, - 5000rpm, they judge with a lean combustion control state, and a throttle opening carries out memory of 3 to Variable C.
[0035] Operational status ** ... An engine speed judges with OBAREBO more than predetermined threshold value, engine temperature judges with abnormality operational status at the time of engine abnormal conditions, such as overheat beyond a predetermined value, and memory of 4 is carried out to Variable C.
[0036] Operational status ** ... When engine temperature is below a predetermined value and a starting switch ON, it judges with a cold start condition and memory of 5 is carried out to Variable C.
[0037] Operational status ** ... At the time of a main switch OFF or the kill switch OFF, it judges with an engine shutdown demand condition, and memory of 6 is carried out to Variable C.
[0038] Operational status ** ... When below a predetermined value and Idle SW (throttle close by-pass bulb completely SW) are ON, they judge with an idle mode, and the time of clutch neutrality or an engine speed carries out memory of 7 to Variable C.
[0039] Operational status ** ... When a switch is ON in EGR control (control the recirculation of a part of exhaust gas is carried out [control] to an inhalation-of-air system), it judges with the EGR control mode, and memory of 8 is carried out to Variable C.
[0040] Operational status ** ... When beyond a predetermined value and a starting switch are ON, they usually judge with an engine start condition, and engine temperature carries out memory of 9 to Variable C.
[0041] Operational status A** ... When abnormality lifting of the combustion chamber internal pressure in front of jump spark ignition, the abnormalities in transition of a chamber pressure, etc. are detected from combustion room pressure data, it judges with abnormal-combustion conditions, such as a preignition condition and a knocking condition, and memory of 10 is carried out to Variable C.
[0042] Moreover, it is referred to as P= 0, when checking step S14 in a what time main routine with a flag P= 1 and exceeding the predetermined time R by the same variable C value.
[0043] At the time of C= 1, at the time of Rc=1C=2, the value of R will be set to Rc=1<Rc=2<Rc=3 by it at the time of Rc=2C=3, if the value of R changes the value of R as Rc=3.
[0044] It is referred to as P= 0 when the C value in the last main routine differs from this C value.
[0045] Step S15: Decision of being mode operation activation is performed, and in one case of 4, 6, and 9, it shifts to step S20, and Variable C shifts to step S16, in being other.
[0046] Step S16: Based on the value of Flag P, in the case of P= 0, ask for the target combustion rate according to an engine speed and a load, and put the result into Memory D with the map data in memory (thing equivalent to drawing 5). Moreover, a fundamental-points fire stage, a basic fuel-injection initiation stage, and basic fuel oil consumption are also calculated from the respectively same map data as drawing 5 in memory (what graphic-display-ized the value given as an engine speed and a function of a load), and are paid to memory E' (1), E' (2), and E' (3), respectively. Then,

it is made P= 1. However, when Variable C is 5, P= 0 asks for a target combustion rate based on the target combustion rate map for cold starts, and makes Memory D memorize the value. In no cases of P= 1, it carries out, but they shift to step S17.

[0047] A combustion rate means the rate of the fuel which burned by whenever [over the fuel which burns in 1 cycle combustion / a certain crank angle]. It is the approach of asking for the chamber-pressure data in two or more points predetermined [in combustion 1 cycle] in one approach by the primary approximation about the count approach of this combustion rate, and another is the approach of calculating the amount of heat release by the thermodynamic formula from the sampled pressure value, and asking for the combustion rate to a predetermined crank angle (for example, top dead center). The count result with both approaches very near true value was obtained. In this case, the data of a chamber pressure detect and ask for the chamber pressure in the crank angle of the 1st period of a before [from after termination of an exhaust stroke / the early stages of a compression stroke]. In this case, the pressure of a combustion chamber is a crank angle in within the limits in the condition of having fallen most and having approached atmospheric pressure, for example, the crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke] is a bottom dead point or its near. That is, in a four stroke cycle engine, the pressure of a combustion chamber declines and atmospheric pressure is approached as are shown in drawing 6 , and the combustion gas of a combustion chamber is discharged by the exhaust stroke from the bottom dead point after explosion and a top dead center is approached. Like the inhalation line after a top dead center, the condition near atmospheric pressure is maintained for the new air conduction close, and a pressure is gradually heightened from the compression stroke after the bottom dead point where an exhaust valve 17 closes and is started through an intake stroke. The pressure of the combustion chamber in one point is detected among the range which the pressure of such a combustion chamber declined and approached atmospheric pressure. Although the crank angle a0 in drawing 6 is taken to BDC, it may be after BDC as long as it is in early stages of a compression stroke. Of course, the crank angle in the inhalation-of-air process in front of BDC is sufficient. On the other hand, with a two-cycle engine, since new mind will be introduced from a crank case if a pressure declines, the pressure of a combustion chamber will decline further according to this if an exhaust port opens, and a scavenging port opens while the piston after explosion falls, as shown in drawing 16 , atmospheric pressure is approached. After the exhaust port has opened, a piston goes up from a bottom dead point, closing, then an exhaust port increase [a scavenging port], and a **** pressure increases [****** and compression] gradually. That is, from after termination of an exhaust stroke before the early stages of a compression stroke, after a scavenging port opens after the exhaust port opened and the exhaust port has opened after exhaust air initiation, and inhalation of air is started, between until an exhaust port closes and compression is started is said. In drawing 16 , the crank angle a0 is taken to BDC.

[0048] Jump spark ignition is performed in front of a compression backward top dead center or to the back. (Jump spark ignition is started in the crank angle expressed with an arrow head and S among drawing 6 and drawing 16 , respectively.) Jump spark ignition is started, it is slightly behind, and lights and combustion is started. The ignition initiation said by each claim is a flash when this firing combustion is started. That is, in the crank angle (drawing 16 drawing 6 , crank angle a1) of the 2nd period which is a period from compression stroke initiation to firing combustion initiation, the pressure of the **** interior of a room is detected. Then, two crank angles in the 3rd period which is a period until an exhaust stroke is started among an explosion combustion stroke from ignition initiation (firing combustion initiation) (it sets to drawing 6 and drawing 16) The pressure of a combustion chamber is detected in crank angle a2a3, the crank angles a2 and a4, the crank angles a3 and a4, the crank angles a2 and a5, the crank angles a3 and a5, or the crank angles a4 and a5. As for one crank angle, it is desirable between two crank angles in this period that it is a front [crank angle / used as the highest firing pressure]. Moreover, when the pressure of a combustion chamber detects in four or more crank angles, for example, the crank angle of five or more points, said by each claim, the number of the pressure survey crank angle points of the 1st or 2nd period may be made to increase. Moreover, in three or more crank angles, pressure detection may be carried out like [it is desirable and] the example of drawing 6 and drawing 16 [within the 3rd period]. By the diesel power plant, the fuel injection before a compression backward top dead center or to an after [a top dead center] combustion chamber is started, it is behind for a while, and combustion starts by spontaneous ignition. That is, by the diesel power plant, the ignition initiation indicated to each claim means the flash when this spontaneous ignition is started. In addition, as reach, spontaneous ignition searches for the ignition delay to initiation beforehand as an engine speed or data based on a load from fuel-injection initiation, this is woven in, it reaches and the pressure crank angle point within the pressure survey crank angle within the 2nd period and the 3rd period is memorized in memory as an engine speed or data based on a load, the pressure survey of a combustion chamber is performed.

[0049] the sum total of such 1st one period, the 2nd one period, and the 3rd two periods -- even if few, the chamber pressure of whenever [crank angle / of four points] is detected, and a combustion rate is calculated for this from a primary approximation. This approximation is combustion rate qx=a+b1*(P1-P0) +b2*(P2-P0)+... It is expressed with +bn* (Pn-P0).

[0050] As shown in a top type, to the pressure data P1-Pn, qx(es) are what applied the constant of b1-bn, and the thing which applied the constant a set up beforehand, and are expressed to what lengthened reference pressure P0 respectively.

[0051] It is what applied the constant to which C1-Cn were set beforehand, and the thing which applied the constant set up beforehand, and is expressed to that to which Pmi lengthened reference pressure P0 respectively to the pressure data P1-Pn similarly.

[0052] P0 is the chamber pressure of the point (as mentioned above for example, whenever [near the BDC / crank angle]) of atmospheric-pressure level, and in order to amend the offset voltage by the drift of a sensor etc., it is subtracted from each pressure value of P1-Pn here. Moreover, a firing pressure [in / in P1 / the crank angle a1 of the 1st period] and P2 are the chamber pressures in the crank angle a2 of the 2nd period. P3-Pn(s) are the crank angles a3-an (this example n= 5) of the 3rd period.

[0053] A value with the combustion rate actual to accuracy to the predetermined crank angle after firing and the almost same value are computed by the operation by such easy primary approximation for a short time. Therefore, while being able to take out the energy by combustion efficiently by controlling engine ignition timing and an engine air-fuel ratio using such a combustion rate, when responsibility is raised and it performs lean combustion control and EGR control, operational status can be followed exactly and output fluctuation can be suppressed. Moreover, generating of NOx by combustion advancing rapidly can be prevented. In the 2nd qx calculation approach, the heating value generated between two pressure survey points (whenever [crank angle]) the differential pressure in both the pressure survey point -- **P and a volume-of-combustion-chamber difference -- if the ratio of specific beat and R make it as an average gas constant and P0 makes amounts, such as heat, and K the pressure value in BDC, P, and V and A the pressure value and volume-of-combustion-chamber value by the side of before [of **V and the two point of measurement]
Amount Qx=Aof heat release/(K-1) * (K+1) (/2***P***V+K*(P-P0) ***V+V***P)
It can ask by carrying out.

[0054] Moreover, the combustion rate to a predetermined pressure survey point selects a crank angle when combustion is completed mostly as a pressure survey point. It is what totaled what calculated the above-mentioned amount Qx of heat release for between [every] each pressure survey point that selected similarly the crank angle near at the time of ignition as a pressure survey point, and the meantime was measured. What totaled what calculated Above Qx about the between to a predetermined pressure survey point (predetermined crank angle) from the first pressure survey point is broken.

[0055] Namely, heating-value x100 of the heating value/all that burned by whenever [crank angle / of combustion rate qx= arbitration] (%)
= Q1+Q2+ ... It is +Qx/(Q1+Q2+ ... +Qn) x100.

[0056] By the above count approaches, the chamber pressure in two or more predetermined crank angles can be measured (setting to step S112 of drawing 3), and the combustion rate to a predetermined crank angle can be computed to accuracy based on the data (setting to step S223 of drawing 8). The stable output and an engine revolution are obtained by controlling an engine using this combustion rate.

[0057] Step S17: Inhalation air-temperature information and inlet-pipe negative pressure information perform the amendment operation of the injection quantity for fuel injection. That is, since air density will become low if inhalation air temperature is high, a substantial air flow rate becomes less. For this reason, the air-fuel ratio in a combustion chamber becomes low. For this reason, the amount of amendments for reducing fuel oil consumption is computed.

[0058] Step S18: The basic fuel-injection initiation according to an engine load and an engine speed, basic fuel oil consumption, and a fundamental-points fire stage are called for at step S16, and are put in by E' (i). According to those information by which memory was carried out to the amount of amendments calculated at step S17 based on this, and memory A (i), the amount of fuel-injection amendments and the amount of ignition-timing amendments are calculated, and, in addition to a reference value, a controlled variable is calculated respectively. This controlled variable sets an ignition initiation stage to memory E (1), an ignition period is set to memory E (2), and an injection initiation stage and an injection termination stage are put into E (3) and E (4) for an injection initiation stage and an injection termination stage at F (3), F (4), and the time of P= 0 at the time of P= 1.

[0059] This is inputted into memory E (i). Similarly according to the information by which memory was carried out to memory A (i), the controlled variable of a servo motor group and a solenoid-valve group is computed, and it puts into memory G (i).

[0060] Step S19: Carry out actuation control of the actuators, such as a servo motor group and a solenoid-valve group, according to the controlled variable of memory G (i).

[0061] Step S20: An engine shutdown demand is judged, when Variable C is 6, it shifts to step S21, and in being other, it shifts to step S22.

[0062] Step S21: Set the halt data which set memory E(i) i=1-4 to 0, or carry out the flame failure of the ignition plug 400.

[0063] Step S22: Variable C judges that it is 9, when Variable C is the usual engine start of 9, shift to step S23, and when that is not right, shift to step S25.

[0064] Step S23: Set the data for making memory F (i) increase slightly the quantity of the angle of delay and fuel oil consumption for the data for start up currently beforehand put into memory, i.e., ignition timing.

[0065] Step S24: Drive a start-up motor.

[0066] Step S25: It is the case where Variable C is 4, and set the data which make the quantity of fuel oil consumption increase, extracting a throttle opening to memory F (i), if it is the data corresponding to the content of abnormalities, for example, OBAREBO, and is a flame failure and overheat.

[0067] Next, interruption routine [of drawing 3] ** is explained. This interruption routine ** will be performed by the main routine by interruption, if the crank signal of a predetermined include angle is inputted.

[0068] Step S111: Set a timer so that interruption routine ** may be performed for every predetermined crank angle, namely, so that the interrupt of whenever [following crank angle] may occur.

[0069] Step S112: Incorporate the pressure data which are whenever [crank angle / which the interrupt generated], and put into memory.

[0070] Step S113: If the pressure data of all crank angles are incorporated by memory, it will shift to step S114.

[0071] Steps S114-S115: Variable C confirms whether to be 10 or not, and, in the case of C= 10, performs and carries out the return of the abnormal-combustion prevention routine of step S115 as abnormal combustion. When that is not right, it moves to step S116.

[0072] Step S116: It confirms whether to be C= 2 and judges whether it is a transient, and it comes out so, and a transient control routine is performed by step S116a at a certain time, and it amends and carries out the return of ignition timing or A/F. Otherwise, it moves to step S117.

[0073] Step S117: It confirms whether to be C= 5, judges whether it is a cold start, and comes out so, and a cold start control routine is performed by step S117a at a certain time, and it amends and carries out the return of the ignition timing. Otherwise, it moves to step S118.

[0074] Step S118: It confirms whether to be C= 8 and judges whether it is the EGR control mode, and it comes out so, and an EGR control routine is performed by step S118a at a certain time, and it amends and carries out the return of an EGR rate or the ignition timing. Moreover, if that is not right, it will move to step S119.

[0075] Step S119: It confirms whether to be C= 3, judges whether it is lean combustion mode, and comes out so, and a lean combustion control routine is performed by step S119a at a certain time, and it amends and carries out the return of A/F or the ignition timing. Moreover, if that is not right, it will move to step S120.

[0076] Step S120: It confirms whether to be C= 7 and judges whether it is idling mode, and it comes out so, and an idling control routine is performed by step S120a at a certain time, and it amends and carries out the return of A/F or the ignition timing. Moreover, if that is not right, a MBT control routine will be performed at step S121, and the return of the ignition timing will be amended and carried out.

[0077] Next, interruption routine [of drawing 4] ** is explained. This interruption routine ** will be performed by the main routine by interruption, if a criteria crank signal is inputted.

[0078] Step S121: Since this interruption routine ** is performed once in an engine revolution and a predetermined crank angle, it measures a period.

[0079] Step S122: Calculate an engine speed.

[0080] Step S123: Set an ignition initiation stage, an ignition termination stage, an injection initiation stage, and an injection termination stage to a timer based on the control data of memory F(i) i=1-4. A timer starts an ignition and a fuel injection equipment to the set timing.

[0081] Next, the calculation of a target combustion rate explained by drawing 2 and drawing 3 is explained to a detail.

[0082] Drawing 5 is drawing of the map for asking for the target combustion rate according to an engine speed and a load. It asks from what map-ized the predetermined crank angle, for example, the combustion rate to a top dead center TDC, as a target combustion rate at the time of lean combustion, and memory is carried out to the storage of a control unit 12. The configuration of the three dimensions as which a target combustion rate is determined by a load (Lx) and the engine speed (Rx) is shown. The target combustion rate in a predetermined service condition (Lx, Rx) is called for as FMB0 (Lxi, Rxi) and i=1-n.

[0083] According to operational status, the target combustion rate data in two or more crank angles are given as target combustion rate data. For example, the target combustion rate data of the predetermined crank angle in early stages of combustion and two or more predetermined crank angles of a combustion anaphase are given.

[0084] Drawing 6 is the graph of the chamber pressure of 1 cycle combustion of a four stroke cycle engine. As for an axis of ordinate, an axis of abscissa shows a firing pressure whenever [crank angle]. The firing pressures P0-P5 in six points of a0-a5 which whenever [crank angle] illustrated are detected, and a combustion rate is computed based on these pressure values. a0 is a bottom dead point location (BDC) which moves from inhalation to compression, and is in the condition almost near atmospheric pressure. a1 is after compression initiation and a2 is the crank angle before arriving at a top dead center (TDC) after jump spark ignition in S before jump spark ignition. Four points of a3-a5 are the crank angles which can be set like the explosion line after a top dead center. A combustion rate is computed based on the pressure data of these each point. In addition, in the case of the diesel power plant by which jump spark ignition is not carried out, a fuel is injected [near the top dead center] like FI. It is behind time to be equivalent to the crank angle after [d] injection initiation, and spontaneous ignition is carried out. The crank angle of spontaneous ignition is set to S. In this diesel power plant, control of fuel injection timing is carried out based on the difference between a target combustion rate or a target crank angle instead of control of ignition timing in an ignition spark system engine, respectively in a location survey combustion rate or a location survey crank angle. The tooth lead angle and angle-of-delay control of the injection initiation stage are carried out, and an injection termination stage is controlled so that the predetermined injection quantity is secured.

[0085] Next, the control of a combustion rate based on the calculation of a combustion rate explained by drawing 2 and drawing 3 is explained to a detail.

[0086] In step S17 of drawing 2 , an amendment operation is performed like the flow chart of the amendment operation of drawing 7 . That is, at the time of a variable C= 2, step S17 is performed, the fuel-oil-consumption amendment operation for atmospheric pressure amendment is carried out from inhalation air-temperature information and inlet-pipe negative pressure information by step S17a, the tic of the variable STATE of a transient control state is performed by step S17b, and when the variable of a transient control state is the steady state of STATE=0, transient amendment data are cleared by step S17c. In not being a steady state, it moves to step S17d, the check of a first time running state is performed [the variable of a transient control state] for the transient of STATE=1, and in being a first time running state, it moves to step S17e. Initial amendment is performed by step S17e, and stage amendment is performed at the point of the fuel-injection data at the time of acceleration and a slowdown amending [loading], and when the variable of a transient control state is STATE=2 in step S17f, it is made the first time running state of transient control.

[0087] Next, a transient control routine is shown in drawing 8 . After this transient control routine performs an initial in the main routine after a transient judging, it is performed the whole ** cycle.

[0088] Step S222: Read the target combustion rate in a transition stage in a map, and move to step S223.

[0089] Step S223: Calculate a actual combustion rate and move to step S224.

[0090] Step S224: If a transient control state variable becomes STATE=2, it will move to step S236. When that is not right, it moves to step S225.

[0091] Step S225: Perform the amendment routine of the amount of fuel supply, and move to step S226.

[0092] Step S226: By the ignition-timing amendment unit IGTDR of an angle-of-delay value, only a predetermined value decreases the ignition-timing correction value IGTD, and move from the ignition-timing initial correction value IGTDO to step S227.

[0093] Step S227: If the correction value IGTD of ignition timing is negative, it will move to step S228. If that is not right, it will move to step S229.

[0094] Step S228: Set ignition-timing correction value IGTD to 0, and move to step S229.

[0095] Step S229: In addition to [one] the transient control activation counter COUNT, move to step S230.

[0096] Step S230: If the transient control activation counters COUNT are the two or more set points COUNT of the number of transient control activation, it will move to step S231. A return will be carried out if that is not right.

[0097] Step S231: Set the transient control state variable STATE to 0, and move to step S232.

[0098] Step S232: Clear and carry out the return of the transient control activation counter COUNT.

[0099] Step S236: When the variable of a transient control state is STATE=2 at step S224, move to step S236, perform the amendment routine of ignition timing at step S236, and move to step S237.

[0100] Step S237: In addition to [one] the transient control activation counter COUNT, move to step S238.

[0101] Step S238: When the transient control activation counters COUNT are the one or more actuation change set points COUNT, move to step S239. A return is carried out when that is not right.

[0102] Step S239: Carry out and carry out the return of the transient control state variable STATE to 3.

[0103] Drawing 9 shows the flow of the transient control routine to which blowdown of NOx etc. can also press down the good acceleration-and-deceleration engine performance by performing feedback amendment control of ignition timing and fuel supply for the optimal firing stage and combustion speed.

[0104] It has a target combustion rate in two or more crank angles, make an early combustion rate into the desired value for controlling a firing stage, and let the change rate of the combustion rate between at least two crank angles be the desired value for rate-of-combustion control. As for rate-of-combustion control, firing stage control makes ignition timing the control input of the amount of fuel supply. this control input -- the difference of desired value and a detection value -- feedback -- things determine.

[0105] Step S500: Read the target combustion rate in a current engine speed and two or more crank angles corresponding to a load from the map memorized as target data at the time of a transient. At the time of acceleration, it is MAPPUDE-TA at the slowdown time and it differs. The above is performed and it moves to step S501.

[0106] Step S5Ol: Calculate the target rate of combustion from two or more target rates read at step S500. For example, the target rate of combustion BSPD is what **(ed) a changed part of the combustion rate of whenever [two crank angle] at spacing whenever [crank angle], and is called for.

[0107] BSPDthetal2=(FMBtheta2-FMBthetal)/(theta2-thetal)
When the desired value read in MABBU at FMBtheta2>FMBtheta1 and theta2>theta1 step S500 is set up as a combustion speed, activation of step S501 is unnecessary. The above is performed and it moves to step S502.

[0108] Step S502: Calculate the actual combustion rate in two or more crank angles to which the target combustion rate is set (it may be henceforth called a detection value and a detection combustion rate). From now on, combustion speed will also be calculated by the same formula as step S501..Next, it moves to step S503.

[0109] Step S503: Take the deflection of desired value and a detection value. For example, deflection deltaFMB of a combustion rate is calculated according to the detection combustion rate FMB (theta 1) and the difference of target combustion rate FMBtheta1.

[0110] Deflection deltaBSPD of combustion speed is calculated like deltaFMB=FMB(theta 1)-FMBtheta1 according to the detection combustion speed BSPD (theta 12), target combustion speed, and the difference of BSPDtheta12.

[0111]
More than deltaBSPD=BSPD(theta 12)-BSPDtheta12 is calculated and it moves to step S504.

[0112] Step S504: Check the feedback prohibition flag of the amount amendment control of fuel supply. When a feedback prohibition flag is ON, it moves to step S509, and amendment control of the amount of fuel supply is not performed. Moreover, when the Phi-DOBAKKU flag is OFF, it moves to step S505, and processing is continued. The feedback prohibition flag of combustion amount-of-supply amendment control is turned on between an after [a return] predetermined cycle, or predetermined time from the FIERU cut at the time of a slowdown after the asynchronous amendment at the time of acceleration. This period supports the response delay of the period over processing of the amount of fuel supply, and the period when feedback is forbidden is made to adjustable according to adapted engine structure and operational status. For example, this long period is taken in the engine with which a fuel is thrown into an inlet pipe, and the engine which supplies a direct fuel to a cylinder is shortened dramatically, or makes and carries out a prohibition period. Moreover, when an engine is in a cold condition, it is made longer than usual. It shortens, when an engine revolution is high, and when low, it lengthens. The above is performed and it moves to step S505.

[0113] Step S505: Amendment control of the amount of fuel supply judges whether it is under [delay cycle] ********. A delay cycle is a cycle for giving and performing an interval to amendment. This absorbs the delay of a response, and surge-fluctuation. Amendment control will be performed if a delay counter is set to O, and it moves from it to step S506. When that is not right, it moves to step S506b.

[0114] Step S5O6: Here, the deflection of desired value and a detection value confirms whether it is the inside of an allowed value. This allowed value is prepared and engine hunting is prevented. If it becomes in an allowed value, amendment control will not be carried out but it will move to step S508. Otherwise, it moves to step S507 and amendment control of the amount of fuel supply is performed.

[0115] Step S507: Perform the amendment routine of the amount of fuel supply of drawing 11 , and move to step S508.

[0116] Step S5O8: Set a predetermined value to a delay counter so that it may become a count delay cycle of predetermined from next time, and move to step S509.

[0117] Step S5O6b: Reduce by one from the delay counter of the amount amendment control of fuel supply, and move to step S507b.

[0118] Step S507**: Deflection is equalized. Moreover, the rate of change of a detection value can be calculated and the validity of amendment can also be evaluated in quest of the stability of combustion. It moves to step S509, without amending by performing the above.

[0119] Step S509: Judge whether it is the delay cycle of ignition-timing amendment control. A delay cycle is a cycle for giving and performing an interval to amendment, and surge-fluctuation is absorbed. Amendment control will be performed if a delay counter is set to 0, and it moves from it to step S510. When that is not right, it moves to step S510b.
[0120] Step S510: Here, the deflection of desired value and a detection value confirms whether it is the inside of an allowed value. Engine hunting is prevented by this allowed value. If it becomes in an allowed value, amendment control will not be carried out but it will move to step S512. Otherwise, it moves to step S511 and amendment control of ignition timing is performed.
[0121] Step S511; the amendment routine of ignition timing of drawing 10 is performed, and it moves to step S512.
[0122] Step S512: Set and carry out the return of the predetermined value to a delay counter so that it may become a count delay cycle of predetermined from next time.
[0123] Step S510**: It reduces by one from the delay counter of ignition-timing amendment control, and moves to step S51O **.
[0124] Step S51lb: Perform the average of deflection. Moreover, the rate of change of a detection value can be calculated and the validity of amendment can also be evaluated in quest of the stability of a period. A return is carried out without amending by performing the above.
[0125] Next, the ignition-timing amendment routine in the case of calculating correction value according to deflection is shown in drawing 10 . An operation of this ignition-timing amendment routine is shown in drawing 12 .
[0126] Step S151: Take deflection deltaFMB of the target combustion rate FMB and the actual value FMB (theta), and move to step S152.
[0127] Step S152: According to deflection deltaFMB, read the amendment variation gi in a map and move to step S153.
[0128] Step S153: Add the amendment variation gi to the ignition-timing correction value IGTD to last time, consider as the ignition-timing correction value IGTD, and move to step S154.
[0129] Step S154: If the ignition-timing correction value IGTD is forward, it will move to step S155a. If it is negative or 0, it will move to step S155b.
[0130] Step [step S155a -] S156a: If close does not require the ignition-timing correction value IGTD for the limit IGTDS by the side of a tooth lead angle, perform step S156a and carry out a return, applying a limit. If Limit IGTDS requires close, a return will be carried out as it is.
[0131] Step [step S155b -] S156b: If close does not require the ignition-timing correction value IGTD for the limit IGTDR by the side of the angle of delay, perform step S156b and carry out a return, applying a limit. If Limit IGTDR requires close, a return will be carried out as it is.
[0132] Next, the amount amendment routine of fuel supply in the case of calculating correction value according to deflection is shown in drawing 11 . An operation of this amount amendment routine of fuel supply is shown in drawing 13 .
[0133] Step S171: Take deflection deltaFMB of the target combustion rate FMB and the actual value FMB (theta), and move to step S172.
[0134] Step S172: Read the amendment variation gf in a map according to deflection deltaFMB, and move to step S173.
[0135] Step S173: Add the amendment variation gf to the correction value FTD of the amount of fuel supply to last time, consider as the correction value FTD of the amount of fuel supply, and move to step S174.
[0136] Step S174: If the correction value FTD of the amount of fuel supply is forward, it will move to step S175a. If it is negative or 0, it will move to step S175b.
[0137] Step [step S175a -] S176a: If close does not require the correction value FTD of the amount of fuel supply for the limit FTDMX by the side of loading, perform step S176a and carry out a return, applying a limit. If Limit FTDMX requires close, a return will be carried out as it is.
[0138] Step [step S175b -] S176b: If close does not require the correction value FTD of the amount of fuel supply for the limit FTDMN by the side of loss in quantity, perform step S176b and carry out a return, applying a limit. If Limit FTDMN requires close, a return will be carried out as it is.
[0139] As mentioned above, it sets to ** of ****** of implementation of this invention. While reaching and carrying out tooth-lead-angle amendment from a throttle opening or ignition timing

based on an engine speed While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side Detect the actual combustion rate to 1 or two or more predetermined crank angles, and it is based on the comparison with the detection value of this combustion rate, and a target combustion rate value. the correction value of said ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- the correction value of the amount of fuel supply after controlling ignition timing -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling .

[0140] In addition, from step S224 in drawing 8 to the step S232 is canceled as ** of ****** of operation, and it may be made to perform step S236 promptly after activation of step S223. Namely, while reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side the actual combustion rate to 1 or two or more predetermined crank angles -- detecting -- the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- ignition timing -- controlling .

[0141] Moreover, from steps S224 and S236 in drawing 8 to S239 is canceled as ** of ****** of operation, and it may be made to perform step S225 promptly after activation of step S223. Namely, while reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more combustion rates in 1 or two or more predetermined crank angles in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target combustion rate values at least corresponding to one side Detect the actual combustion rate to 1 or two or more predetermined crank angles, and it is based on the comparison with the detection value of this combustion rate, and a target combustion rate value. the correction value of the amount of fuel supply -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- the direction of a detection value -- size -- the time -- the amount of fuel supply -- decreasing -- as -- the amount of fuel supply -- controlling .

[0142] As the ** of an operation gestalt, while reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side Detect the actual crank angle value to 1 or two or more predetermined combustion rates, and it is based on the comparison with the detection value of this crank angle, and a target crank angle value. In addition to the correction value of ignition timing, when the detection value is later, a fire stage is set forward, and when the detection value is earlier, ignition timing may be controlled to delay a fire stage.

[0143] As the ** of an operation gestalt, while reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side Detect the actual crank angle value to 1 or two or more predetermined combustion rates, and it is based on the comparison with the detection value of this crank angle, and a target crank angle value. In addition to the correction value of the amount of fuel supply, when the detection value is later, the amount of fuel supply is increased, and when the detection value is earlier, the amount of fuel supply may be controlled to decrease the amount of fuel supply.

[0144] As ** of ****** of operation, while reaching and carrying out tooth-lead-angle amendment at the time [ignition timing / a throttle opening or / based on an engine speed] of transient detection While carrying out loading amendment from a throttle opening or the amount of fuel supply based on [reach and] an engine speed The combustion condition that NOx falls while corresponding to at least one side among a load or an engine speed and acquiring the best torque is acquired. 1 or two or more crank angle values used as 1 or two or more predetermined combustion rates in this combustion condition While holding in memory among a load or an engine speed as map data of 1 or two or more target crank angle values at least corresponding to one side Detect the actual crank angle value to 1 or two or more predetermined combustion rates, and it is based on the comparison with the detection value of this crank angle, and a target crank angle value. So that in addition to the correction value of ignition timing it sets forward a fire stage when the detection value is later, and a fire stage may be delayed, when the detection value is earlier In addition to the correction value of fuel oil consumption, after controlling ignition timing, when the detection value is later, the amount of fuel supply is increased, and when the detection value is earlier, the amount of fuel supply may be controlled to decrease the amount of fuel supply.

[0145] In gestalt [of the operation described above as ** of ****** of operation] **, **, or ** the actual combustion rate to a predetermined crank angle The crank angle of a before [from after termination of an exhaust stroke / the early stages of a compression stroke], and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected, and it was made to compute based on these combustion rate data.

[0146] In ** of ****** of operation, the actual crank angle which reaches a predetermined combustion rate value in gestalt [of the above mentioned operation] **, **, or ** The crank angle from after termination of an exhaust stroke to the early stages of a compression stroke, and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected, and it was made to compute based on these combustion rate data.

[0147] Drawing 12 is drawing showing change of the combustion rate FMB by ignition-timing actuation. When the tooth lead angle of the 11A is being carried out from proper ignition timing, 11B shows the case where the angle of delay is being carried out from proper ignition timing, and if the combustion rate of the location survey in a predetermined crank angle (for example, B) is a1 [larger] than a target combustion rate (for example, A), it will carry out the angle of delay of proper ignition-timing and 11C. Moreover, if it is a2 [smaller than a target combustion rate (for example A)], a tooth lead angle will be carried out.

[0148] Moreover, if the crank angle of the location survey which reaches a predetermined combustion rate (for example, A) is b2 [larger] than a target crank angle (for example, B), a tooth lead angle will be carried out. If it is b1 [smaller than a target crank angle (for example, B)], the angle of delay will be carried out.

[0149] Drawing 13 is drawing showing change of the combustion rate FMB by the amount actuation of fuel supply. When more rich than proper A/F, 11B shows the case, Lean [proper A/F and 11C / A/F / proper], and 12A will decrease the quantity of a fuel, if the combustion rate of the location survey in a predetermined crank angle (for example, B) is a1 [larger] than a target combustion rate (for example, A). If it is a2 [smaller than a target combustion rate (for example, A)], the quantity of a fuel will be increased.

[0150] A target crank angle is searched for with the map data of drawing 14 . That is, in drawing 14 , when target crank angle CRAs0 (Rxi, Lxi) which are setting to target crank angle CRA which should reach a predetermined combustion rate, and should reach an axis of abscissa at a load (L) and an axis of ordinate to a predetermined combustion rate, for example, 60%, 70%, 80 etc.%, etc. are actual engine-speed rpm (Rx) and a actual engine load (Lx), it asks from a map. Target crank angle CRA0 (Rxi, Lxi) is calculated as i=1-n. The crank angle value data which reach two or more combustion rates as crank angle value data which reach a predetermined combustion rate in case a normal combustion condition is acquired are given.

[0151] Drawing 15 is the block diagram of the two-cycle engine with which this invention is applied. Like the four stroke cycle engine of drawing 1 , a connecting rod 246 is connected with a crankshaft 241, and a combustion chamber 248 is formed between the piston at the head, and the cylinder head. The engine speed sensor 267 and the crank angle detection sensor 268 for detecting the mark of the ring wheel with which the crankshaft 241 was equipped, and detecting whenever [reference signal and crank angle] are formed in the crank case 300. Moreover, the crank room pressure sensor 210 is formed in the crank case 300. Air is sent to a crank case 301 through a reed valve 228 from an inlet manifold. Air is sent to an inlet manifold from an air cleaner 231 through a throttle valve 204. The inhalation-of-air path of the throttle-valve downstream which is open for free passage to an inlet manifold is equipped with the pressure-of-induction-pipe sensor 211. A throttle valve 204 is operated by the grip 206 connected with the wire 205 through the throttle pulley 203. The edge of a steering handle 207 is equipped with a grip 206, and the accelerator location sensor 202 is formed in the bottom section. 212 is a throttle opening sensor.

[0152] A scavenging port 229 carries out opening to a cylinder, and a combustion chamber 248 and a crank case 301 are made to open for free passage through a scavenge air passage 252 in the predetermined location of a piston. Moreover, an exhaust port 254 carries out opening to a cylinder, and a flueway 253 is open for free passage. The flueway wall near the exhaust port is equipped with the exhaust air timing adjustable valve 264. This adjustable valve 264 is driven with the actuator 265 which consists of a servo motor etc., the opening location of an exhaust port is changed, and the timing of exhaust air is adjusted. The ******** sensor 213 and the exhaust pipe temperature sensor 223 are formed in the exhaust pipe which constitutes this flueway 253. Moreover, in a flueway, it drives with the actuator 282 with which the flueway valve 281 consists of ****, a servo motor, etc. The flueway valve 281 prevents the rat tail blow by by the low-speed area, and plans rotational stability.

[0153] A knock sensor 201 attends the cylinder head at a mounting eclipse and a combustion chamber, and it is equipped with an ignition plug 400 and the chamber-pressure sensor 200. An ignition plug is connected with ignition control equipment 256. Moreover, a cylinder side attachment wall is equipped with an injector 208. A fuel is sent to an injector 208 through the fuel delivery tubing 209.

[0154] Moreover, the combustion gas room 279 which is open for free passage into a part from exhaust air boat opening of a cylinder bore with the free passage hole 278 in the middle of the part of cylinder head approach and an exhaust port is formed in the cylinder block. This free passage hole is set up so that the combustion gas which sets like an explosion line and hardly contains blow-by gas may be introduced into the above-mentioned combustion gas room. O2 sensor 277 which detects the oxygen density in combustion gas is attached in this combustion gas interior of a room. In addition, a non-illustrated check valve is arranged at the induction of combustion gas room HE, and the blowdown section of exhaust air POTOHE, and a reverse direction flow is prevented, respectively.

[0155] Actuation control of such an engine is carried out by the control unit 257 which has CPU271. The above-mentioned chamber-pressure sensor 200, a knock sensor 201, the accelerator location sensor 202, the crank room pressure sensor 210, the pressure-of-induction-pipe sensor 211, the throttle opening sensor 212, the ******** sensor 213, the crank angle detection sensor 258, an engine speed sensor 267, and O2 sensor 277 are connected to the input side of this control unit 257. Moreover, an injector 208, the actuator 265 for exhaust air timing regulator valves, and the actuator 282 for exhaust valves are connected to the output side of a control device 257.

[0156] Drawing 16 is the same graph of a chamber pressure as the above-mentioned four stroke cycle engine and drawing 6 to show the point for combustion rate measurement of said two-cycle engine detecting [combustion pressure data]. As mentioned above, chamber-pressure data are sampled whenever [crank angle / of six points]. Within the limits of an in [drawing] A is a crank angle field as for which the exhaust port is carrying out opening, and within the limits of B is a crank angle field as for which the scavenging port is carrying out opening. How to take whenever [each crank angle] (a0-a5) and the count approach are the same on the above-mentioned four stroke cycle engine and parenchyma, are step S113 of interruption routine ** of drawing 3 , detect the firing pressures P0-P5 in six points of a0-a5 which whenever [crank angle] illustrated, and compute a combustion rate based on these pressure values. Each example of this invention can adopt what supplies combustion with a carburetor.

[0157]

[Effect of the Invention] As described above, while invention according to claim 1 carries out tooth-lead-angle amendment of the ignition timing at the time of transient detection The combustion condition that NOx falls while the best torque is acquired is acquired. At the time of this combustion condition Detect the actual combustion rate to 1 or two or more predetermined crank angles, and it is based on the comparison with the detection value of this combustion rate, and a target combustion rate value. the correction value of ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- Since ignition timing is controlled to delay a fire stage the event of the direction of a detection value becoming size, engine power can be maintained greatly, and acceleration nature can be improved, or the engine stall tightness at the time of a sudden slowdown can be improved, and the exhaust air emission nature at the time of a transient response can be raised further.

[0158] While invention according to claim 2 carries out loading amendment of the amount of fuel supply at the time of transient detection The combustion condition that NOx falls while the best torque is acquired is acquired. At the time of this combustion condition Detect the actual combustion rate to 1 or two or more predetermined crank angles, and it is based on the comparison with the detection value of this combustion rate, and a target combustion rate value. the correction value of the amount of fuel supply -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- Since the amount of fuel supply is controlled to decrease the amount of fuel supply when the direction of a detection value becomes size, engine power can be maintained greatly, and acceleration nature can be improved, or the engine stall tightness at the time of a sudden slowdown can be improved, and the exhaust air emission nature at the time of a transient response can be raised further.

[0159] While invention according to claim 3 carries out tooth-lead-angle amendment of the ignition timing at the time of transient detection While carrying out loading amendment of the amount of fuel supply, the combustion condition that NOx falls while the best torque is acquired is acquired. The actual combustion rate to 1 or two or more predetermined crank angles is detected in this combustion condition. the comparison with the detection value of this combustion rate, and a target combustion rate value -- being based -- the correction value of ignition timing -- in addition, the direction of a detection value -- smallness -- an event -- a fire stage -- advancing -- the direction of a detection value -- size -- an event -- a fire stage -- delaying -- as -- the correction value of the amount of said fuel supply after controlling ignition timing -- in addition, the direction of a detection value -- smallness -- the time -- the amount of fuel supply -- increasing -- Since the amount of fuel supply is controlled to decrease the amount of fuel supply when the direction of a detection value becomes size, engine power can be maintained greatly, and acceleration nature can be improved, or the engine stall tightness at the time of a sudden slowdown can be improved, and the exhaust air emission nature at the time of a transient response can be raised further.

[0160] While invention according to claim 4 carries out tooth-lead-angle amendment of the ignition timing at the time of transient detection The combustion condition that NOx falls while the best torque is acquired is acquired. At the time of this combustion condition Detect the actual crank angle value to 1 or two or more predetermined combustion rates, and it is based on the comparison with the detection value of this crank angle, and a target crank angle value. In addition to the correction value of said ignition timing, a fire stage is set forward when the detection value is later. Since ignition timing is controlled to delay a fire stage when the detection value is earlier, engine power can be maintained greatly, and acceleration nature can be improved, or the engine stall tightness at the time of a sudden slowdown can be improved, and the exhaust air emission nature at the time of a transient response can be raised further.

[0161] While invention according to claim 5 carries out tooth-lead-angle amendment of the ignition timing at the time of transient detection The combustion condition that NOx falls while the best torque is acquired is acquired. At the time of this combustion condition Detect the actual crank angle value to 1 or two or more predetermined combustion rates, and it is based on the comparison with the detection value of this crank angle, and a target crank angle value. In addition to the correction value of the amount of fuel supply, when the detection value is later, the quantity of the amount of fuel supply is increased. Since the amount of fuel supply is controlled to decrease the amount of fuel supply when the detection value is earlier, engine power can be maintained greatly, and acceleration nature can be improved, or the engine stall tightness at the time of a sudden slowdown can be improved, and the exhaust air emission nature at the time of a transient response can be raised further.

[0162] While invention according to claim 6 carries out tooth-lead-angle amendment of the ignition timing at the time of transient detection While carrying out loading amendment of the amount of fuel supply, the combustion condition that NOx falls while the best torque is acquired is acquired. The actual crank angle value to 1 or two or more predetermined combustion rates is detected in this combustion condition. So that it sets forward a fire stage when the detection value is later, and a fire stage may be delayed in addition to the correction value of ignition timing based on the comparison with the detection value of this crank angle, and a target crank angle value, when the detection value is earlier After controlling ignition timing, when the detection value is later, in addition to the correction value of said fuel oil consumption, the amount of fuel supply is increased. Since the amount of fuel supply is controlled to decrease the amount of fuel supply when the detection value is earlier, engine power can be maintained greatly, and acceleration nature can be improved, or the engine stall tightness at the time of a sudden slowdown can be improved, and the exhaust air emission nature at the time of a transient response can be raised further.

[0163] The combustion rate to a predetermined crank angle that invention according to claim 7 is actual The crank angle from after termination of an exhaust stroke to the early stages of a compression stroke, and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected. Since it computes based on these combustion rate data, the actual combustion rate to a predetermined crank angle is appropriately computable based on firing-pressure data.

[0164] The actual crank angle to which invention according to claim 8 reaches a predetermined combustion rate value The crank angle from after termination of an exhaust stroke to the early stages of a compression stroke, and the crank angle from compression stroke initiation to ignition, The firing pressure in at least four crank angles which consist of two crank angles in the period from ignition initiation to exhaust stroke initiation is detected. Since it computes based on these combustion rate data, the actual combustion rate to a predetermined crank angle is appropriately computable based on firing-pressure data.

[Translation done.]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the jump-spark-ignition type four stroke cycle engine which is two or more cylinders with which this invention is applied.
[Drawing 2] It is the flow chart of the main routine which controls various engine operational status.
[Drawing 3] It is drawing showing interruption routine **.
[Drawing 4] It is drawing showing interruption routine **.
[Drawing 5] It is drawing of the map for asking for the target combustion rate according to an engine speed and a load.
[Drawing 6] It is the graph of the chamber pressure of 1 cycle combustion of a four stroke cycle engine.
[Drawing 7] It is the flow chart of an amendment operation.
[Drawing 8] It is a transient control routine.
[Drawing 9] It is a transient control routine.
[Drawing 10] It is an ignition-timing amendment routine in the case of calculating correction value according to deflection.
[Drawing 11] It is the amount amendment routine of fuel supply in the case of calculating correction value according to deflection.
[Drawing 12] It is drawing showing change of the combustion rate FMB by ignition-timing actuation.
[Drawing 13] It is drawing showing change of the combustion rate FMB by the amount actuation of fuel supply.
[Drawing 14] It is drawing of the map for asking for the target combustion rate according to an engine speed and a load.
[Drawing 15] It is the block diagram of the two-cycle engine with which this invention is applied.
[Drawing 16] It is the same graph of a chamber pressure as drawing 6 of the above-mentioned four stroke cycle engine to show the point for the output torque of a two-cycle engine, and combustion rate measurement detecting [combustion pressure data].
[Description of Notations]

1	Engine
9	Crankshaft
10	Flywheel Starter Gear
11	Crank Angle Sensor
12	Control Unit
13	Combustion Chamber
25	Oxygen Density Sensor (O2 Sensor)
26	Temperature Sensor
31	Throttle Opening Sensor
32	Pressure-of-Induction-Pipe Force Sensor
34	Heat Ray Type Inhalation Air Content Sensor
36	Inhalation Air Temperature Sensor
105	Injector
106	Regulator

120 Exhaust Pipe Temperature Sensor
150 It is Sensor whenever [Catalyst Temperature].

[Translation done.]

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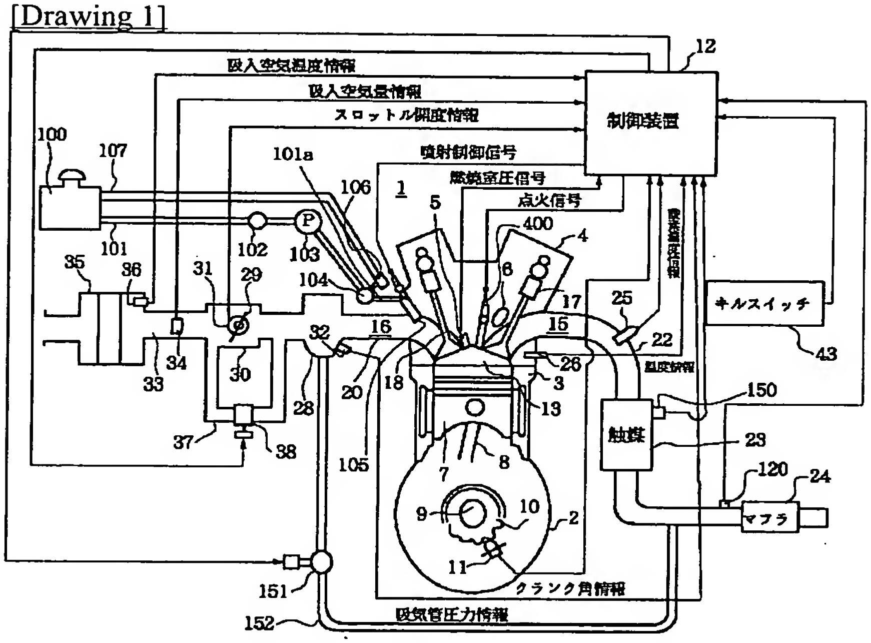
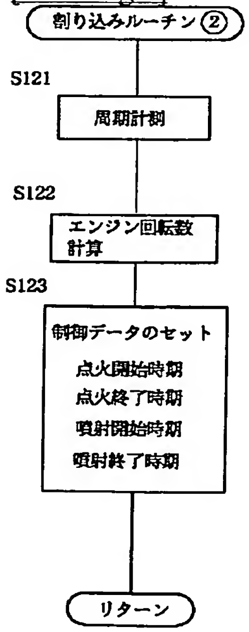
DRAWINGS

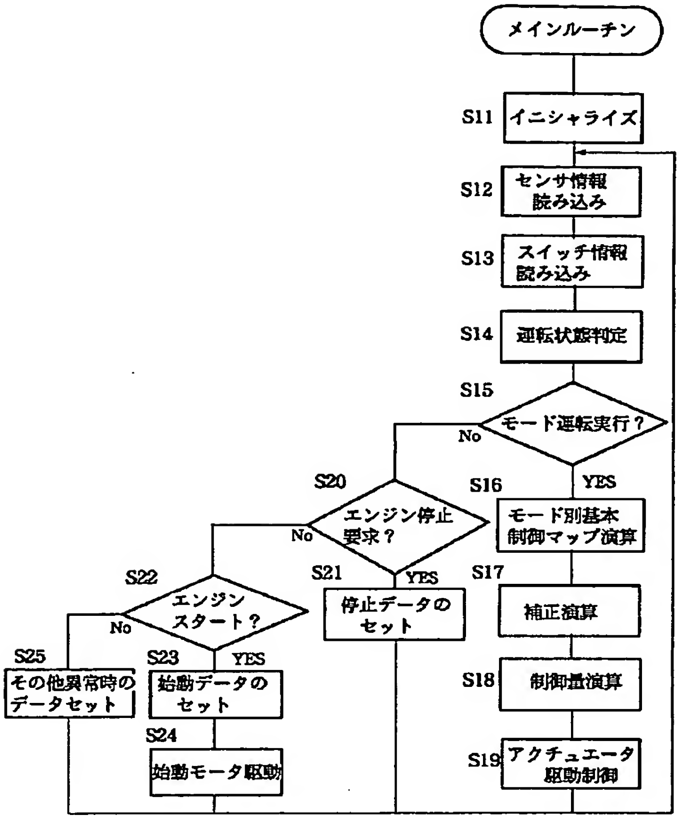
[Drawing 1]


12
吸入空気温度情報
吸入空気量情報
スロットル開度情報
制御装置
100
107
101a
噴射制御信号
106
1
燃焼室圧信号
点火信号
5
400
4
101
102
103
104
35
36
31
29
6
17
25
キルスイッチ
32
16
15
22
34
30
26
43
33
20
18
3
温度情報
28
13
150
37
38
105
7
8
触媒
23
120
24
9
10
2
マフラ
11
151
クランク角情報
152
吸気管圧力情報

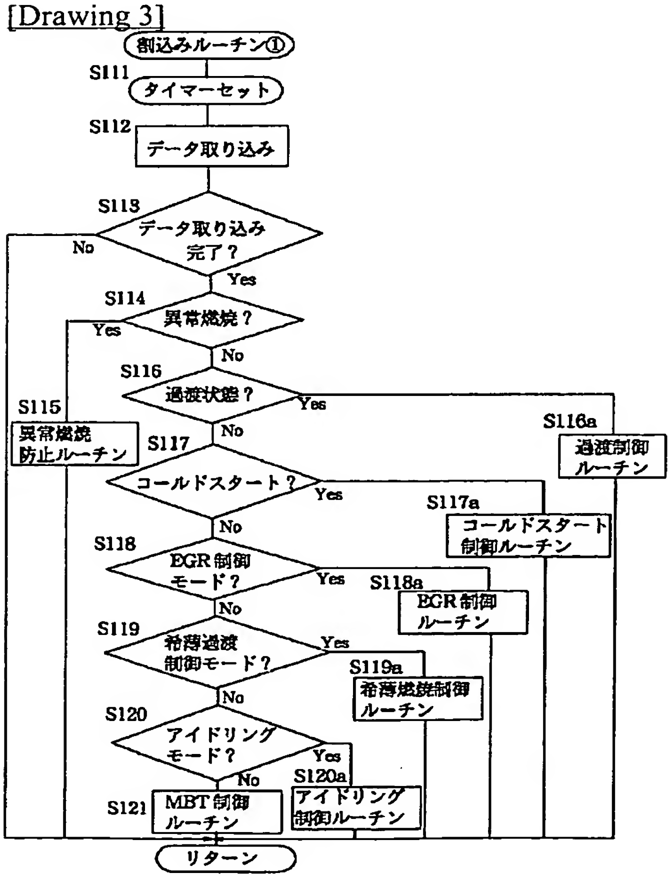
[Drawing 4]


割り込みルーチン②
S121
周期計測
S122
エンジン回転数計算
S123
制御データのセット
点火開始時期
点火終了時期
噴射開始時期
噴射終了時期
リターン

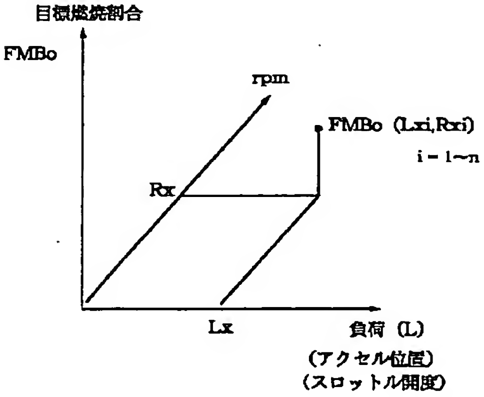
[Drawing 2]


メインルーチン
S11
イニシャライズ
S12
センサ情報読み込み
S13
スイッチ情報読み込み
S14
運転状態判定
S15
モード運転実行？
No
YES
S16
モード別基本制御マップ演算
S17
補正演算
S18
制御量演算
S19
アクチュエータ駆動制御
S20
エンジン停止要求？
No
YES
S21
停止データのセット
S22
エンジンスタート？
No
YES
S23
始動データのセット
S24
始動モータ駆動
S25
その他異常時のデータセット

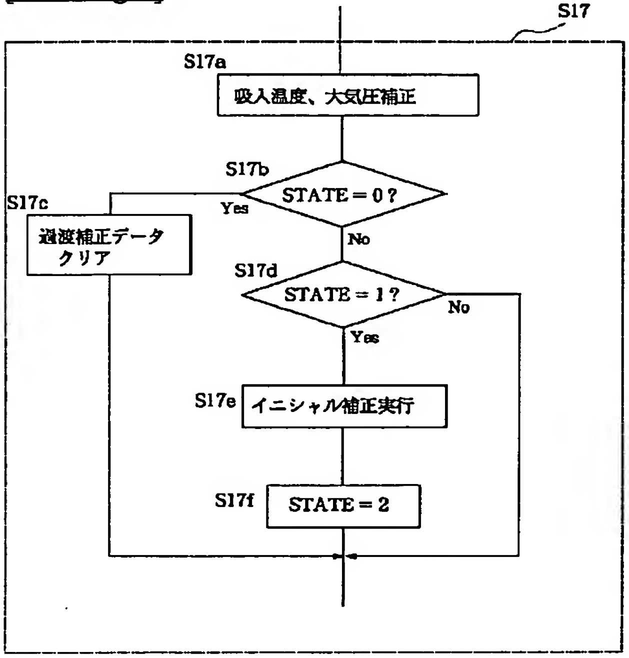
[Drawing 3]


割込みルーチン①
S111
タイマーセット
S112
データ取り込み
S113
データ取り込み完了？
No
Yes
S114
異常燃焼？
Yes
No
S115
異常燃焼防止ルーチン
S116
過渡状態？
Yes
No
S116a
過渡制御ルーチン
S117
コールドスタート？
Yes
No
S117a
コールドスタート制御ルーチン
S118
EGR制御モード？
Yes
No
S118a
EGR制御ルーチン
S119
希薄過渡制御モード？
Yes
No
S119a
希薄燃焼制御ルーチン
S120
アイドリングモード？
Yes
No
S120a
アイドリング制御ルーチン
S121
MBT制御ルーチン
リターン

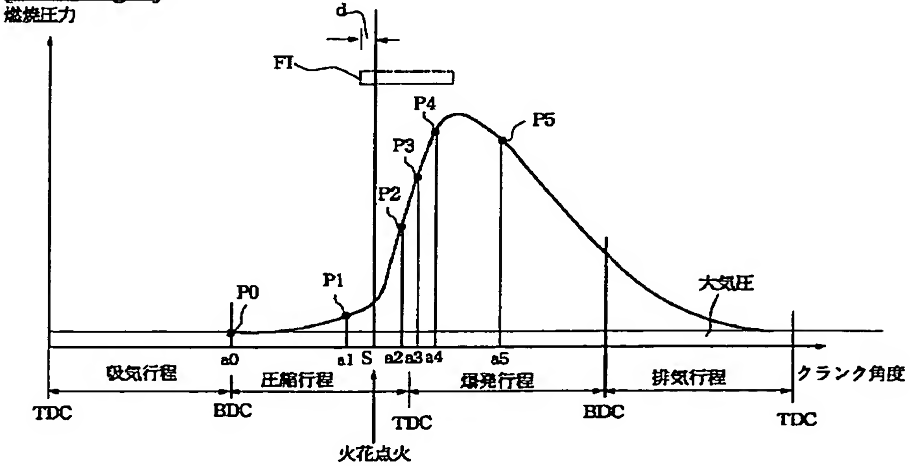
[Drawing 5]



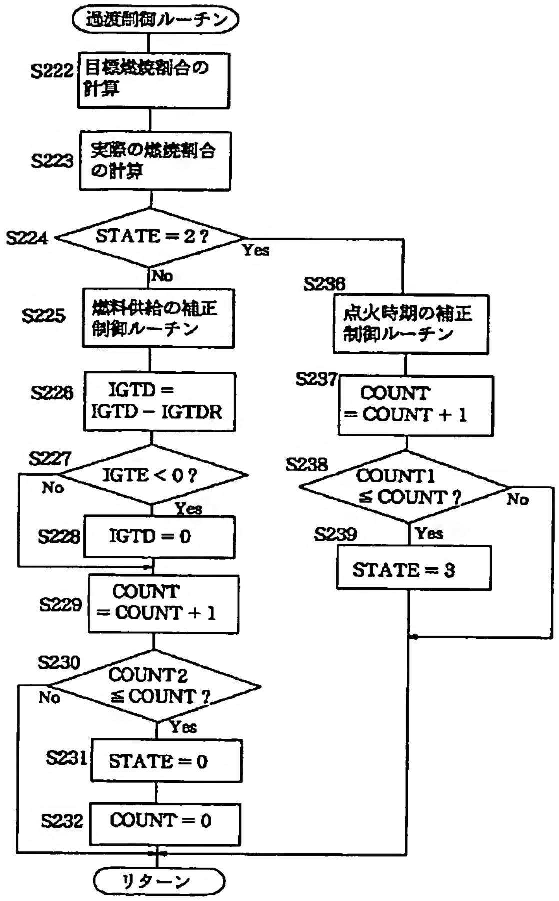
[Drawing 7]


S17
S17a
吸入温度、大気圧補正
S17b
STATE = 0 ?
Yes
No
S17c
過渡補正データクリア
S17d
STATE = 1 ?
Yes
No
S17e
イニシャル補正実行
S17f
STATE = 2

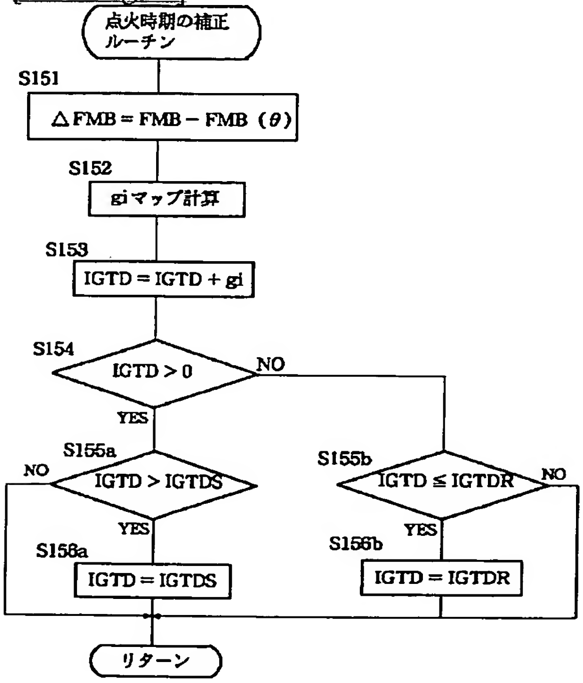
[Drawing 6]



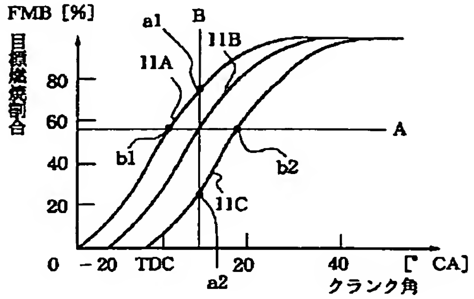
[Drawing 8]


過渡制御ルーチン
S222
目標燃焼割合の計算
S223
実際の燃焼割合の計算
S224
STATE＝2？
Yes
No
S225
燃料供給の補正制御ルーチン
S226
IGTD＝IGTD－IGTDR
S227
IGTE＜0？
No
Yes
S228
IGTD＝0
S229
COUNT＝COUNT＋1
S230
COUNT2≦COUNT？
No
Yes
S231
STATE＝0
S232
COUNT＝0
S236
点火時期の補正制御ルーチン
S237
COUNT＝COUNT＋1
S238
COUNT1≦COUNT？
No
S239
Yes
STATE＝3
リターン

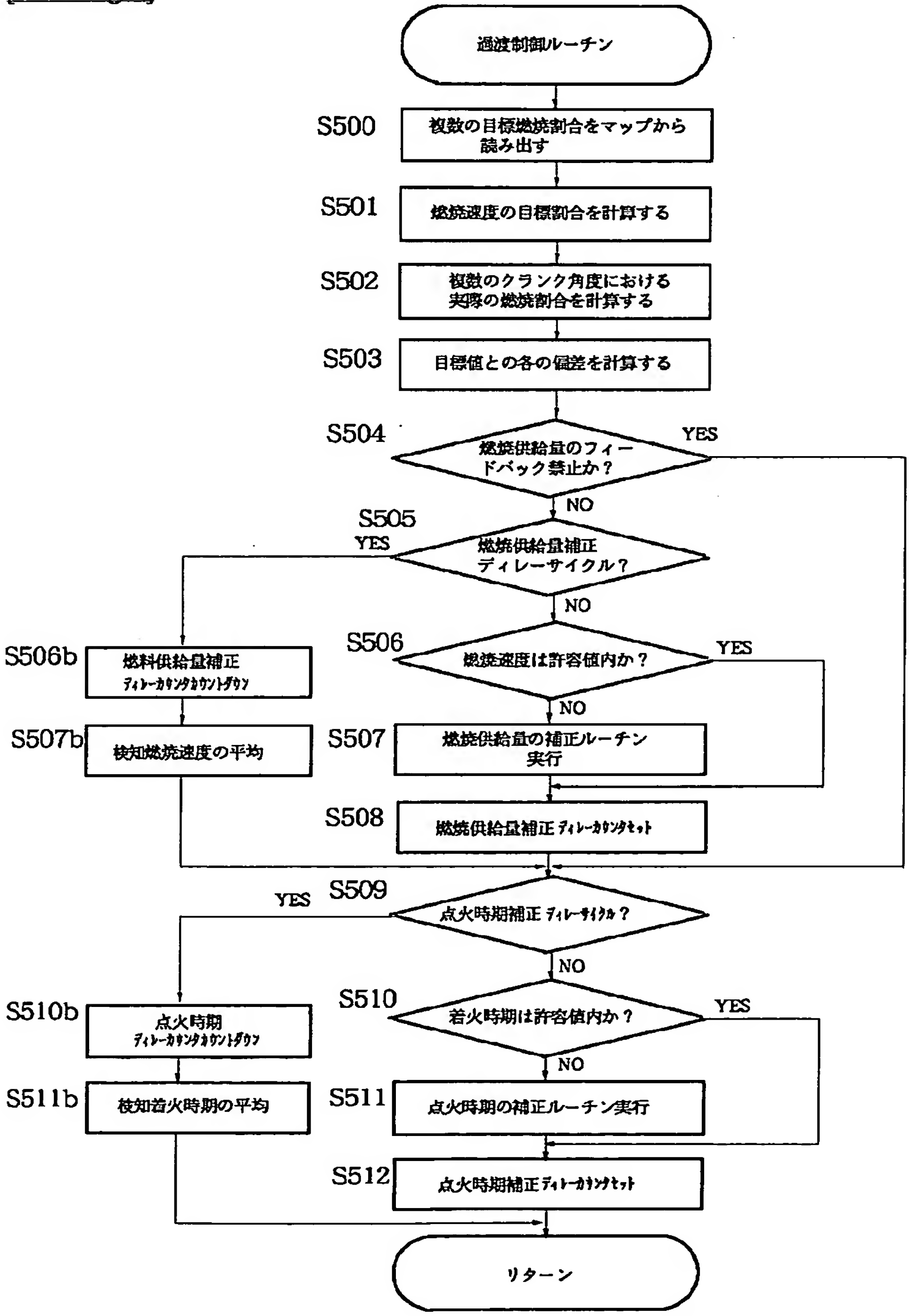
[Drawing 10]


点火時期の補正ルーチン
S151
ΔFMB＝FMB－FMB（θ）
S152
giマップ計算
S153
IGTD＝IGTD＋gi
S154
IGTD＞0
NO
YES
S155a
NO
IGTD＞IGTDS
YES
S156a
IGTD＝IGTDS
S155b
IGTD≦IGTDR
NO
YES
S156b
IGTD＝IGTDR
リターン

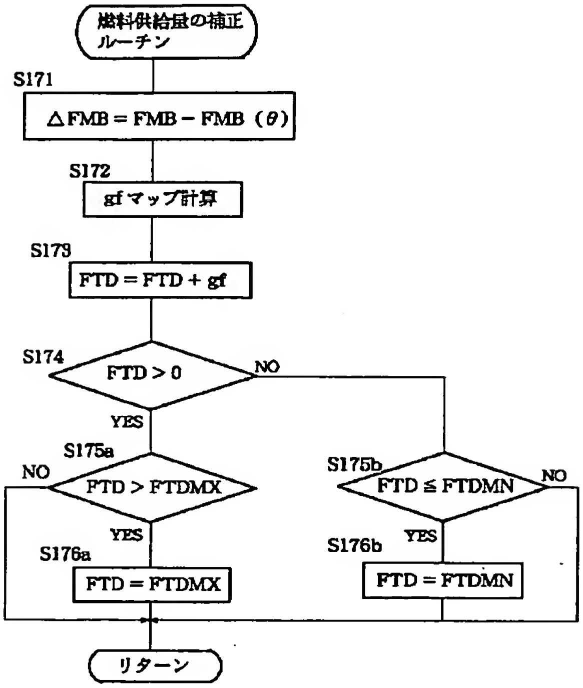
[Drawing 12]



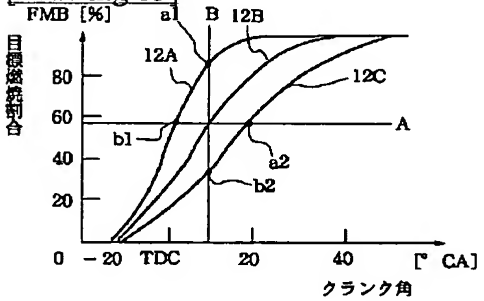
[Drawing 9]


過渡制御ルーチン
S500
複数の目標燃焼割合をマップから読み出す
S501
燃焼速度の目標割合を計算する
S502
複数のクランク角度における実際の燃焼割合を計算する
S503
目標値との各の偏差を計算する
S504
燃焼供給量のフィードバック禁止か？
YES
NO
S505
燃焼供給量補正ディレーサイクル？
YES
NO
S506b
燃料供給量補正ディレーカウンタカウントダウン
S507b
検知燃焼速度の平均
S506
燃焼速度は許容値内か？
YES
NO
S507
燃焼供給量の補正ルーチン実行
S508
燃焼供給量補正ディレーカウンタセット
S509
点火時期補正ディレーサイクル？
YES
NO
S510b
点火時期ディレーカウンタカウントダウン
S511b
検知着火時期の平均
S510
着火時期は許容値内か？
YES
NO
S511
点火時期の補正ルーチン実行
S512
点火時期補正ディレーカウンタセット
リターン

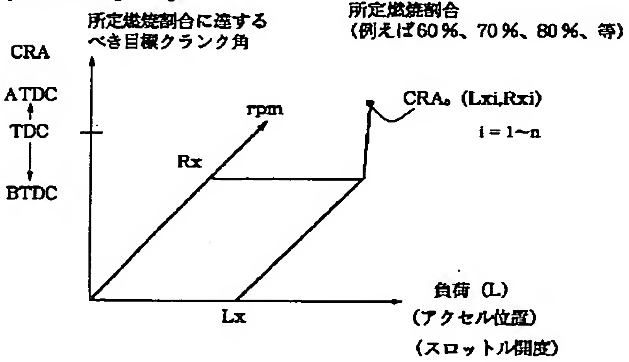
[Drawing 11]


燃料供給量の補正
ルーチン
S171
ΔFMB = FMB − FMB（θ）
S172
gf マップ計算
S173
FTD = FTD + gf
S174
FTD > 0
NO
YES
S175a
NO
FTD > FTDMX
YES
S176a
FTD = FTDMX
S175b
FTD ≦ FTDMN
NO
YES
S176b
FTD = FTDMN
リターン

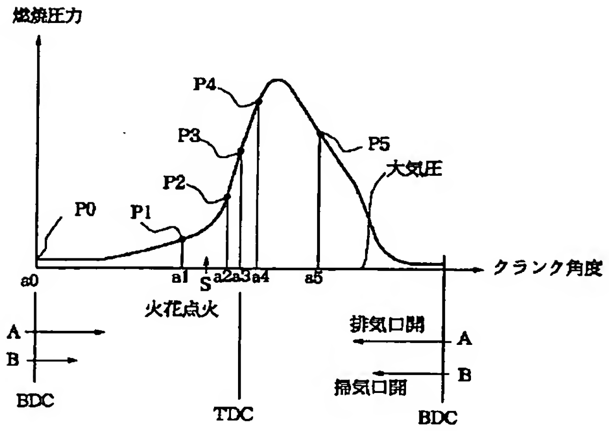
[Drawing 13]



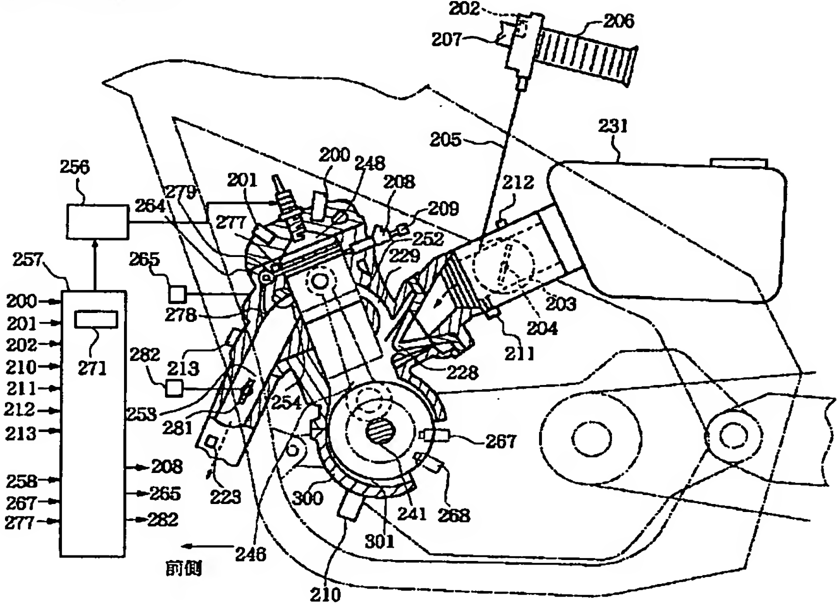
[Drawing 14]



[Drawing 16]



[Drawing 15]


202
206
207
205
231
256
200
248
208
212
201
209
264
279
277
252
229
257
265
203
200
201
278
204
202
211
210
228
211
271
282
213
212
213
253
254
281
267
258
208
265
267
282
277
223
300
241
268
301
246
前側
210

[Translation done.]